NANYANG TECHNOLOGICAL UNIVERSITY

School of Electrical and Electronic Engineering

eeworld

Volume 15 / Year 2013

ENVISION. ENABLE. EMPOWER.

Chair's Message

I am pleased to present this edition of eee world for 2012/2013 as it reflects the exciting and fruitful year we have had.

The following pages will reveal that staff, faculty, students and alumni have made significant progress and contributions, and what's more, enjoyed themselves tremendously in the process.

Our achievements in developing the means to convert practically any surface into a touch sensitive screen, creating our VIRTUS chipset which can function a thousand times faster than Bluetooth, and devising a collapsible music keyboard, should make us all proud.

I am also heartened at how EEE has supported and nurtured a student who courageously and successfully overcame hearing loss to graduate from EEE despite several odds. In the same vein, our students and staff also put in their heart and soul in Vietnam, helping villagers as part of the Green Summer Project, our Overseas Community Involvement Project.

We not only enjoyed the hospitality of others in foreign lands, we also hosted foreign students in Singapore, particularly under NTU's Summer Research Internship and our very own EEE Research Attachment Programme. They were from all over the globe and I trust we have built new bridges connecting our budding counterparts from other cultures and countries.

All work and no play makes a dull engineer. We have none of that in EEE. The Alumni AGM held at Gardens by the Bay, the EEE Graduates' Evening at Marina Bay Sands and the inspired performances at EEE Night all demonstrate how we are able to have fun amidst serious business.

These are just some highlights of the year gone by. Let everything unfold as you flip through the pages and relive the good memories. I have every confidence the next year will be equally colourful and creative.

Professor Yoon Soon Fatt
Chair
School of EEE

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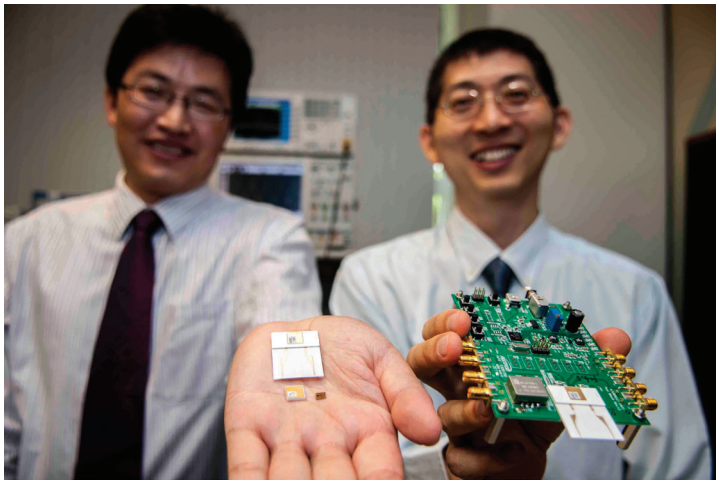

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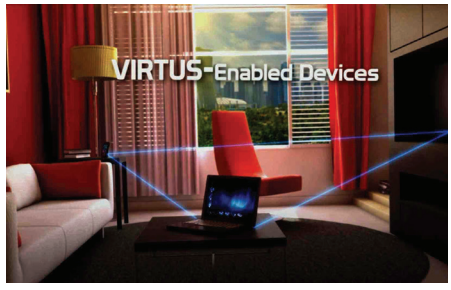
01 (L to R) Dr Ma Kaixue and Prof Yeo Kiat Seng hold different variations of the VIRTUS Microchip
02 The VIRTUS Microchip enables mobile devices like smartphones and laptops to wirelessly transfer data at phenomenal speeds
03 The VIRTUS Microchip enables smartphones to stream HD videos on projectors in real time without the use of cables

VIRTUS Chipset races ahead 1,000x faster than Bluetooth



In September 1958, the electronics industry was on the cusp of change. An inventor by the name of Jack Kilby had developed the first-ever integrated circuit. The earliest version of the integrated circuit was just an oscilloscope attached to a small ribbon of germanium. But it did the trick. Kilby passed in a current and a sine wave registered. And so the world of electronics entered a new age.

Fast forward a few decades—a new breakthrough will once again enter the annals of history, with credit going to the scientists at NTU and A*STAR Institute for Infocomm Research (I²R). Led by Principal Investigator Prof Yeo Kiat Seng, NTU, the research team has successfully revolutionised integrated circuits and developed a microchip that can transmit large packets of data at ultra-high speeds.

The product: the VIRTUS chipset, which is a low-power 60 Gigahertz (GHz) solution. It comprises three components: an antenna, a radio-frequency transceiver—conceived by NTU—and a baseband processor, which is the brainchild of I²R.

The antenna is connected to the transceiver. The transceiver will filter and amplify the signals, following which it passes them to the baseband processor.

The processor consists of non-linear analogue signal processing, unique digital parallel processing and decoder architecture, all of which enable the chipset to operate while consuming little power.

This salient feature means it can be used in gadgets such as smartphones and tablets. Data can now also be transmitted between these gadgets and media devices such as projectors and TVs without the need for cables.

“The demand for ultra high-speed wireless connectivity has fuelled the need for faster data transfer rates. Unfortunately, current technologies are unable to meet these stringent demands,” Prof Yeo opines.

That is set to change with the advent of the VIRTUS chipset. With two gigabits per second of information, it is thus able to transmit data 1,000 times faster than Bluetooth. In other words, what takes Bluetooth 8.5 hours to transmit, this microchip takes just half a minute to transfer a two-hour movie file of eight gigabytes.

To date, the VIRTUS chipset has garnered 16 international patents. This nifty semiconductor has also appeared in 51 international journals and conference papers.

“The success of this project would not be possible without the right strategic partnerships and excellent team spirit. They are critical to the development of 60GHz technologies, solutions and applications. Moving forward, the team will be accelerating the pace of innovation, both technically and in terms of product marketing and integration as well as commercialisation strategies. We will be creating many exciting devices targeting a broad range of new applications, including system-on-chip for future smartphones, storage, tablets and computers,” Prof Yeo adds.

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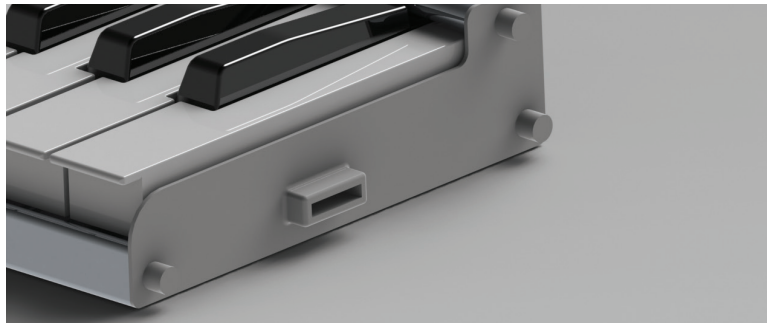

Music: More Ways to Connect

Introducing a new modular music keyboard prototype based on Arduino Platform.

Imagine if you could customise the length of your music keyboard and be able to bring it anywhere with you in a small carrying bag, and expect the quality sound needed for a performance.

Hobbyist composer and music producer Liu Yuning (Class 2013, Information Engineering and Media, EEE, NTU) was inspired to make such a keyboard in his final year project—a keyboard that could be both versatile and mobile, without compromising the music.

Under the supervision of Assoc Prof Lin Zhiping (Division of Information Engineering), and with the help of Mr Li Shiwei (from School of Electric and Electronic Engineering, NTU) and Ms Wang Ziyin (from School of Mechanical and Aerospace Engineering, NTU) on the mechanical design and hardware design, Mr Liu came up with a keyboard with a "modular connection" which allows keyboard players to attach an arbitrary number of keyboard modules.

Much like Apple's Macbook MagSafe connector, there are three strong magnets that assist the connection process. Once the keyboard is connected, the microprocessor inside recognises it and will automatically re-configure the keyboard key's map to adjust the performance.

This product has a good potential market for music arrangers, composers and hobbyists. Musicians like Riduan Yusoff, Wilson Tan and Eddie Chow have reviewed the project and given positive comments. The project is now ready for commercialisation.

For more information on this project, please contact Mr Liu at liuy0071@e-ntu.edu.sg. The demonstration mp3 file is available at: http://www.ntu.edu.sg/home/ezplin/DemoMagKey.mp3.

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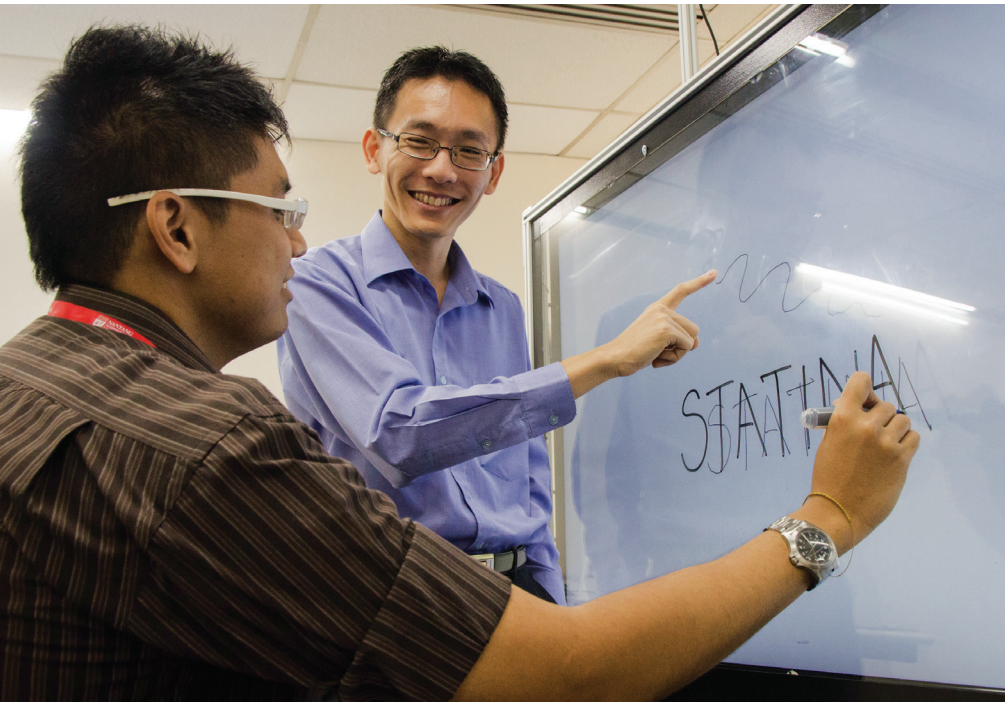
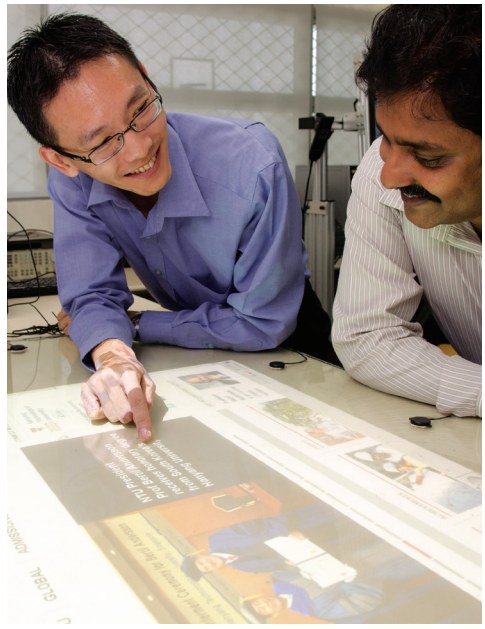
01-03 Prototype of new modular music keyboard





Next Generation Human Computer Interface for Everyday Objects

"The world is your canvas." This saying has now taken on a more literal meaning.

STATINA, which stands for "Speed Touch and Acoustic Tangible Interfaces for Next-generation Applications", is the latest touch-sensing technology developed by NTU. This system transforms any hard surface—wood, metal or glass—into a touchscreen, as if by means of some arcane magic!

After four years in the making, Asst Prof Andy Khong was finally able to unveil the fruits of his labour in July 2013. He and his team were knee-deep in the research of the propagation of vibration waves on solid surfaces. Through the use of low-cost vibration sensors and a wholly unique signal processing algorithm, the system can determine with precision the location of a light tap on a surface. Hook it up to a web camera and the movement of fingers or objects on the surface can be tracked. "Since sound waves propagate through matter at a certain speed, it is possible to derive the location of the touch based on when each sensor picks up the signal," explains Asst Prof Khong.

The practical uses of STATINA are many. Retrofit the system onto a flat-panel TV and the latter becomes a touch-sensitive display screen. Connect it to a computer and it can double up as interactive billboards, mall directories and even as a digital whiteboard to draw on.

"In future, you could play computer games or draw sketches on walls or windows since almost all surfaces can be made touch-sensitive with our system," says Asst Prof Khong.

STATINA uses low-cost equipment and this translates to considerable savings. The current display screens fetch a price to the tune of thousands of dollars—utilising STATINA will only cost users a fraction of this hefty price.

Already making headlines around the world, this trailblazing technology has also been published in several academic publications and conference papers. The research findings were also documented in the journal by the Institute of Electrical and Electronics Engineers, the world's largest professional association in this industry. In December 2012, the team also won the Prestigious Engineering Achievement Award, which is recognised by The Institution of Engineers Singapore.

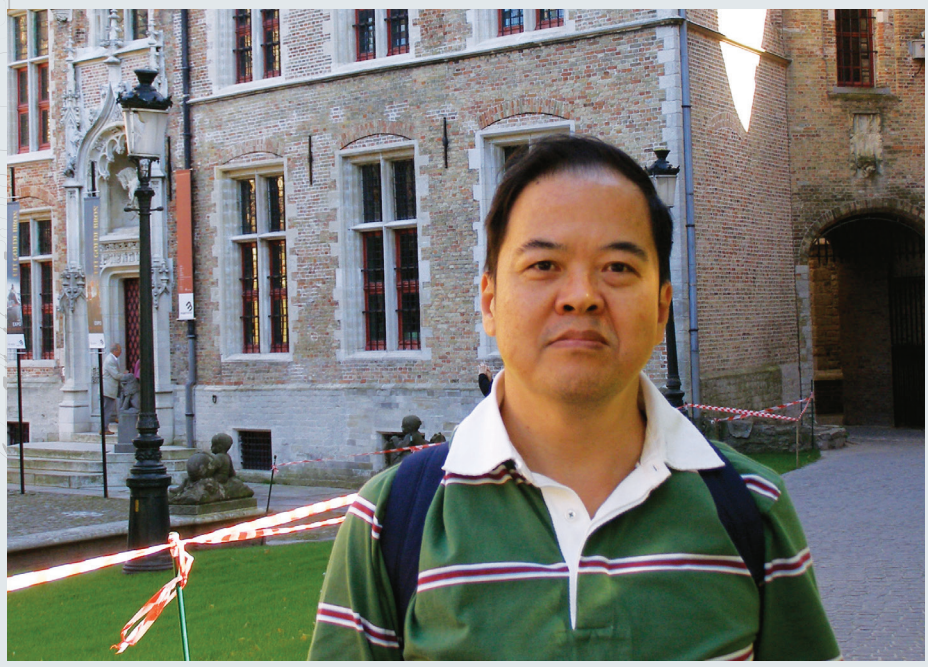
In the pipeline are plans to commercialise this invention by developing a more compact system. Asst Prof Andy Khong and his team are also looking to expand STATINA's capabilities to include the tracking of movements using optical cameras.

01 02

01 Asst Prof Andy Khong with his undergraduate student Zaw Lin demonstrating the touch interface technology on a 50" flat panel display
02 Asst Prof Andy Khong and Research Fellow Dr V. G. Reju using their prototype

Touching Lives Daily

Prof Ma regards Engineering as something cool, interesting and useful.



"My elevation to the grade of IEEE Fellow (Class 2013) is in recognition of my contributions to image processing and digital video coding, in which I have enjoyed working on for more than 24 years," shares Prof Ma Kai Kuang from the Division of Information Engineering at the School of EEE.

IEEE is the largest and highest professional society in electrical and electronic engineering. Reaching the grade of Fellow definitely requires fellow members' and peers' recognition and recommendation.

From young, engineering was a personal preference and ambition, and Prof Ma liked the systematic work, derivations and the reasoning process it demanded. He recalls: "Engineering was something cool, interesting and useful, because you can make an impact on people's lives."

His foray into Electronic engineering was in the same spirit. "In my early days, Electronic engineering involved very interesting things; I was excited by the electronic calculators back when I was in college." Prof Ma could see the impact electronic engineers had on the daily lives of people, and also how it could raise the bar in the way people do things, and achieve even more.

"The highest research impact in my case relates to digital video compression that leads to contributions in the international video compression standard, Moving Picture Experts Group (MPEG). Two fast motion estimation techniques for speeding up digital video compression, diamond search and MVFAST, have been adopted by MPEG-4 standards in 1999 and 2000, respectively. Armed with these achievements, my laboratory had continued the development of another advanced technique, adaptive rood pattern search method, as well as other video encoding optimisation components; all these have resulted in high paper citations." It is thanks to such research that people all over the world can now easily access and view videos on all kinds of platforms.

The way for Prof Ma to make this significant contribution opened up in EEE. "I have to thank the fact that Prof Er appointed me as Singapore's MPEG Chairman. That provided the privilege and opportunity to see where I can contribute more. It encouraged me to do a lot of work and more testing. I presented new results at each successive meeting of the Committee. Without being MPEG Chairman, I would not have gotten my work through the door."

In fact, he says many people have contributed to his journey, "All my research collaborators and students who contributed to my research findings and fundamental understanding; my Ph.D. supervisor, Prof Sarah A. Rajala, who led me into this exciting research area and nurtured my research ability in early days; my colleague Prof Lim Yong Ching; my close friend and mentor Prof C.C. Jay Kuo; my IEEE Fellow application's nominator Dr Shawmin Lei and all my referees, whose joint efforts made my IEEE Fellow application a success."

"THE HIGHEST RESEARCH IMPACT IN MY CASE RELATES TO DIGITAL VIDEO COMPRESSION THAT LEADS TO CONTRIBUTIONS IN THE INTERNATIONAL VIDEO COMPRESSION STANDARD, MOVING PICTURE EXPERTS GROUP (MPEG)." — PROF MA KAI KUANG

"TEACHING IS ABSOLUTELY MY FIRST LOVE, WHICH IS QUITE IRONICAL GIVEN THAT I NEVER INTENDED TO BE IN ACADEMICS! THE POWER TO EDUCATE HUNDREDS OF STUDENTS EVERY YEAR, AND TO SHAPE THEIR THINKING AND CAREERS, ISN'T THAT MOTIVATION ENOUGH?" — PROF LALIT GOEL

The Accidental Engineer

If there is any way to sum up the path Prof Lalit Goel has taken into the field of Engineering, it would be "by accident".

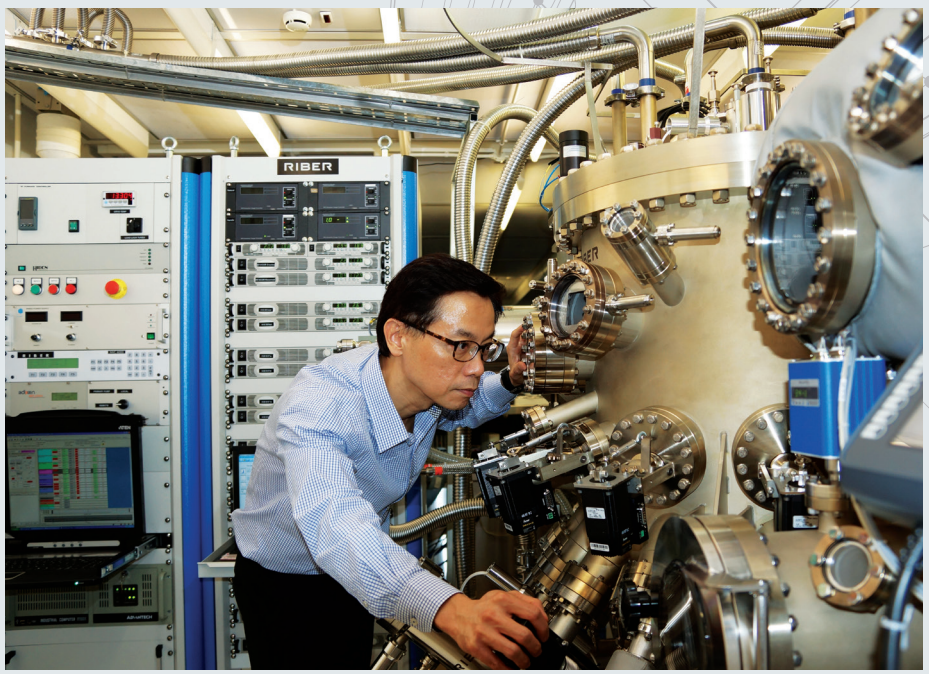
"I actually never wanted to be an engineer —my dream was to become a medical doctor! Ironically I did become a 'Doctor', but of engineering, not medicine!" Prof Goel recalls with characteristic humour. "Getting into medicine was very hard in the late 1970s so some wise men asked me to apply for engineering, and the rest as they say, is history!"

Indeed, Prof Goel has made history. He has recently joined the illustrious league of IEEE Fellows, one of the foremost distinctions for an engineer. "Each year, following a rigorous evaluation procedure, the IEEE Fellows Committee recommends a select group of recipients for one of its most prestigious honours, elevation to IEEE Fellow. I used to think of that as a 'rare honour'. Such recognition by peers is very satisfying on a professional basis. Thus, I feel both pride and humility at being bestowed with this honour."

This recognition is certainly no accident as Prof Goel is dedicated and passionate about his work. In his 22-year career, Prof Goel has chaired IEEE committees, received awards from that renowned organisation, and been editor for international engineering journals. He is currently the Director of Undergraduate Education (Projects), President's Office. But the true highlight of his career is reflected in tributes to his teaching style, for he has won several NTU teaching awards. Students appreciate his ability to explain difficult concepts in simple terms and "my sending a clear unequivocal signal that I am there for them, putting myself in their shoes, and injecting humour in the classroom".

Prof Goel models his successful methods on his own inspiring mentors. "My MS and Ph.D. supervisor, Prof Roy Billinton, was the best thing that happened to me. His influence on me as a great teacher, researcher, and mentor was profound." To some extent, he believes he has emulated Prof Billinton's style in his own teaching, research and mentorship at NTU.

Teaching had opened a whole new vista for him. "Teaching is absolutely my first love, which is quite ironical given that I never intended to be in academics! The power to educate hundreds of students every year, and to shape their thinking and careers, isn't that motivation enough? The pleasure that I derive from relating to students, guiding them not just in academics but also in other aspects, seeing them succeed in their careers, is indescribable. To make friends with students, to be part of the holistic journey of future leaders, entrepreneurs, engineers and policy-makers, provides the greatest satisfaction."



Staying Focused, Staying Relevant

Prof Yoon Soon Fatt sees collaborative partnerships as one of the ways forward for EEE.

Prof Yoon Soon Fatt feels there isn't a job in the world which is important and doesn't come with problems—it doesn't exist. "Otherwise, the job is not important." With a mindset like that, nothing could possibly get the better of Prof Yoon Soon Fatt, Chair of EEE.

He assumed office on 1 July 2013 and has braced himself for the immense task ahead. He is taking over a fine institution but has no illusions as to what he is up against in taking EEE to the next level. "The technological landscape is always changing. What was relevant yesterday may not be relevant today. But we also have limited resources. So we have to focus on strategic areas in research and know what kind of student we want to mould," Prof Yoon outlines.

But he is also aware that EEE's strengths will stand the school in good stead. "We are in a strong position to move forward very quickly in bio-medical engineering and the new domain of Internet of Things. Someone may talk casually about something today but it can be a very big thing later—so we need to be quick enough to be early investors in those areas."

Prof Yoon, therefore, is clear about his role in steering EEE in the right direction, "My task as a leader is to make people excited about new things. If I can persuade the top 20 to 30 percent to see a particular point of view, then the others will emulate them for they are role models for success."

Indeed, he sees collaborative partnership as the way forward for EEE, even in student engagement. "Ours is a bilateral relationship with students to make them successful. We want them to say what they would like in order to enhance their experience here, and to come forward voluntarily in networking activities and thematic programmes."

The fluid, dynamic and organic nature of engineering, especially in this day and age, gets Prof Yoon all fired up. "Every document and every process is a living document and process. What you do today will be a data point that leads to the next data point. So don't worry about tomorrow's work—just prepare the ground. Let's embrace that to make EEE and NTU even bigger and better."

"OURS IS A BILATERAL RELATIONSHIP WITH STUDENTS TO MAKE THEM SUCCESSFUL. WE WANT THEM TO SAY WHAT THEY WOULD LIKE IN ORDER TO ENHANCE THEIR EXPERIENCE HERE, AND TO COME FORWARD VOLUNTARILY IN NETWORKING ACTIVITIES AND THEMATIC PROGRAMMES."
— PROF YOON SOON FATT

From Laboratory to the Marketplace

Researchers dream of the day their research gets commercialised. Before this dream can be realised, they need to pique the interest of investors and secure funding. This is where Senior Assistant Director Colin Leong comes in.

As an industry liaison, a typical week for Colin includes meeting up with faculties and understanding their research. He also touches base with industry players, who send him requests for new technologies that will improve their existing businesses. “Part of my job is to match our faculty’s on-going research with companies’ technological needs.”

Colin’s job is one of special importance, as he helps to ensure that the research undertaken by the School is ultimately pushed to the market. “The School of EEE is always at the forefront of developing new sciences that will benefit the society at large. The desired outcome of the meet-ups between faculties and potential collaborators is the establishment of new research partnerships.”

Colin hopes that his work will help raise the faculty’s profile in the industry. To do his job well as a spokesperson, Colin has to make sense of the research coming out from the School, which is the culmination of many years of hard work. He has a Bachelor’s degree in Electrical and Electronic Engineering, an MBA and a Graduate Certificate in Intellectual Property Law; his background helps him to some extent. “At the School, discoveries are made in fields spanning from IC design to power electronics. So I try to read a lot and understand the practical benefits of these new technologies.”

Every Day a Surprise

Dr Edwin Teo joined the School of EEE in December 2012 as an Assistant Professor in the Division of Microelectronics. He reveals to eee world why he loves his career where he can pursue his passion and interest, and share them as well.

What led you to choose engineering as your field of study?
One of my earliest memories was having to do a drawing of what my parents did for a living. I asked my father and he said, “I am an electronics engineer.” I was disappointed because I thought “manager” would have been more impressive. His reply, which resonated with me, was “anyone can be a manager but very few can call themselves an engineer”.

I remember eventually drawing him in yellow hard hat and boots, which I assumed then was the attire of an engineer. Once, he took me to his office and I looked at all the cool assembly lines, N_2 cylinders and vents. I guess the seed was planted then. My fascination with how things work and an intrinsic want to explore pushed me further to pursue engineering research.

How would you describe your career?
A career in research & development is usually preceded by careful planning and lots of patience and hard work. Nothing is really charted in the career path of a R&D guy. Every day, there is always something new, something unexpected and something different.

Explain to us your current research focus.
My interest has always been in designing and synthesising new materials from basic components like carbon and boron nitride. We have created a two-tiered material using only various forms of carbons. Currently, we are working with various partners to interface our materials with their current products and systems.

What are your thoughts about today’s generation of students? What advice would you give them?
In a word: fast. They are quick to pick up new ideas, fast to learn new tools and they always have information on the latest trends.

As for advice, it is to learn to accept failures, build strong friendships because through them you will really grow, learn to congratulate yourself on the smallest achievement and to “think long, look wide” for the next thing to strive for!

Navigating to the Finals in Munich

Giving students the opportunity to think and work like a professional engineer is the aim of the Rohde & Schwarz (R&S) Case Study Competition. Held annually, the competition rallies students from all around the world and gets them to brainstorm creative approaches to solve problems.

This year, participants were thrust into the world of car radar systems. The topic centred on the development of a car radar system that could automatically detect the distance between cars while driving. The competition tested their understanding on requirements for frequency modulated continuous wave radar systems, signal integrity and component tests for airbag control systems.

The NTU team comprised four students from the School of EEE and a student from the School of Computer Engineering. They participated in the preliminary round in Singapore on 22 May 2013 and won the first prize which was a fully endorsed trip to Munich, Germany, to participate in the final round.

Throughout the competition, the team gained valuable technical knowledge and opportunities to immerse in the R&S company culture. The team had to present their findings to a jury consisting of a representative from a university, a R&S engineer as well as a human resource officer. Even though they did not win in the final round, the team had a great learning experience. They also met with Minister for Education Mr Heng Swee Keat who was visiting R&S headquarters.

This was a simulation of what engineers have to do in real life. Beyond solving everyday problems, they must also have the ability to articulate their work and help others understand what it is they do. Summing up his experience, EEE student Dinh Hung Tu exclaimed: “Being exposed to Rohde & Schwarz company culture and its R&D in technology has really inspired us to dive deeper into the realms of technology!”

01 02

01-02 NTU team with their supporters

Flying High

For NTU’s EEE Class of 2012, the overall employment rate reported is 90.4%.

87.6%
of graduates are employed in full-time permanent jobs.

$

$3,359
Average Gross Monthly Salary of Class 2012 Graduates

*Figures taken from the survey results at MOE website www.moe.gov.sg/education/post-secondary/files/ges-ntu.pdf

One of the biggest concerns for graduating students is job prospects and their employability. In this regard, our Class of 2012 has proven that the School of EEE is a place where competent engineers are groomed.

The Graduate Employment Survey (GES) is an annual survey published by the Ministry of Education. For the first time ever, the GES was jointly conducted by NTU, NUS and SMU. The survey tracks the employment outcomes of fresh graduates six months after they receive their degrees. Prospective students can then use the information to help them make informed decisions about their career paths.

A total of 14,067 graduates were surveyed. 91% of graduates have managed to secure a job. 85.6% of them are employed in full-time permanent jobs. The average gross monthly salary is $3,260.

For our Class of 2012, the overall employment rate reported is 90.4%. 87.6% of our graduates have managed to get full-time permanent jobs. On average, our fresh graduates are earning a gross monthly salary of $3,359. The top earners in the 75th percentile take home an average of $3,500.

Against the national benchmarks, these findings are motivating. They are proof that our students join us as aspiring individuals and graduate as talents armed with the necessary skill sets. More importantly, they are sought after by employers and they get to enjoy a promising start to a lifelong career.

Willing Heart, Ready Hands

Driven by their heart for society, our EEE LEAD students are ever ready to give of themselves to improve the lives of others. Through the Local and Overseas Community Involvement Programmes, they were able to touch lives in and beyond Singapore.

Into the Galaxy of Learning

01 02

03

01 The EEE LEAD LCIP Team
02-03 Briefing on the difference phases of the moon

Eighteen volunteers from EEE LEAD, led by Oh Zhen Cheng, EEE Year 3 and S Supraja, EEE Year 1, shed light on the universe for some underprivileged 9- to 12-year-olds.

They were part of a Local Community Involvement Project (LCIP) organised by the Chinese Development Assistance Council (CDAC). The 16 March event aimed to rouse the children's love for learning through fun and creativity. Of the four booths dedicated for the exploration of Maths, Science, English and the Solar System, the EEE LEAD LCIP Team was assigned the last and most exciting one.

Let the Games Begin

The immense potential of the subject matter had allowed the team to brainstorm and develop challenging age-appropriate games with the aim to educate and entertain. The games involved arranging planets in order, guessing the relative sizes of planets as well as visualising various phases of the moon with the help of a miniature model constructed by our creative LEAD students.

Beyond Infinity

Still, the universe can be an abstract concept for primary-schoolers. However, the children were able to grasp the concept easily through the clear briefing by our LEAD students and the use of telescopes to observe the moon and stars. The observations recorded by the children further demonstrated that our students achieved the learning outcome of this activity.

Learning in Return

Much effort and teamwork went into the project—from collaborating with an external organisation, planning and executing event logistics, to managing a crowd of 173 highly-enthusiastic children and thinking on their feet to answer the barrage of questions by these curious minds. The very buzz of this scale made this first joint effort between EEE LEAD and the CDAC a highly enjoyable and satisfying one.

Touching Lives in Hòa Phú Village, Da Nang, Vietnam

This 2013 Semester 2 vacation was life-changing for 12 EEE undergraduate students. Led by Assoc Prof Ng Beng Koon, Ms Eileen Chia and Mr Thomas Foo, our students were in Da Nang, Vietnam from 10 to 20 July for a six-day Green Summer Project 2013an overseas community involvement project. They joined a team of 100 Da Nang University students on the quest to improve living conditions in Hòa Phú, a rural village in the South Central Coast of Vietnam.

Dam Clearing

To enable an unobstructed flow of fresh water, the students cleared vegetation that were growing wild on the dam wall and in the outlet canals. Trekking 1.5km out of the village, they arrived sweat-drenched at the worksite. There, their Vietnamese teammates taught them to fell small trees with a sickle and uproot plants with their bare hands—a novel experience for city-dwelling Singaporeans. At one stage, village children braving humidity and heat, chipped in.

"THE VILLAGE YOUTHS CAME TOGETHER FOR ONE COMMON GOAL. THEY THOUGHT ABOUT OTHERS RATHER THAN JUST ABOUT THEIR INDIVIDUAL NEEDS AND WANTS."
– RICHARD KONG, EEE YEAR 3.

Road Construction

Constructing proper roads is the first step to improving rural mobility which will, over time, boost the village's economy. The team began by building a 200m road segment. From manually digging the ground with spades, to picking out stones to ensure quality of the cement mix, to ensuring correct road thickness, they worked around the shortage of machinery and emerged ahead of schedule—with a day to spare!

01 02 03 04

01 Say 'cheese', posing together for a group photo
02 Removing bushes
03 Preparing cement for the road
04 A cleaner dam after clearing

"IT AMAZES ME THAT EVEN STUDENTS LIKE US COULD CREATE SUCH A CONSTRUCT THAT WILL LAST FOR TEN OR MORE YEARS AND BE OF GREAT SERVICE TO MANY PEOPLE." – JAMIE LIM, EEE YEAR 1

Social Work
The students had the opportunity to interact with the local villagers when they went door-to-door to coax the local children from each household to join them for English lessons. Their efforts were paid off with over 50 children turning up for lessons at the community centre.

Initially, our students had difficulty communicating with the children, but this was quickly rectified with the help of their Da Nang University teammates. To capture the children's hearts and minds, our students used creative teaching methods—using balloons to differentiate colours and a telescope for lessons on the solar system. With positive outlook and enthusiasm infused into their lessons, our students were able to keep the children engaged.

While we gave, we also gained. We experienced, first-hand, rural Vietnamese culture, habits and lifestyle by participating in the villagers' daily routines—eating with them, celebrating with them, visiting their homes, and so on. We grew so close to the villagers that parting was bittersweet—it was difficult to leave behind the new friendships forged, yet new adventures around modern Vietnam beckoned.

"I COULDN'T STOP MY TEARS FROM FLOWING. HAVING WORKED AND LIVED TOGETHER WITH THE VIETNAMESE STUDENTS FOR ONE WEEK, I FELT REALLY SAD WHEN WE HAD TO LEAVE THEM. WE WILL REALLY MISS THEM A LOT!" – HSHIEH YEU YANN, IEM YEAR 1.

"WE USE ENGLISH SO OFTEN IN OUR DAILY CONVERSATIONS THAT IT IS EASY TO FORGET THAT ENGLISH WAS ONCE A FOREIGN LANGUAGE THAT WE HAD TO LEARN. IT WAS INTERESTING AND CHALLENGING TO HAVE TO PUT OURSELVES IN THE CHILDREN'S SHOES AND FIND WAYS TO INTRODUCE ENGLISH TO THEM WHEN WE OURSELVES COULDN'T SPEAK TO THEM IN VIETNAMESE!" – ANN NIVEDHA, EEGT YEAR 1

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03

01 Injecting fun into learning
02 EEE LEAD team and Da Nang University students with the villagers
03 A job well done

SRI and ERAP: A Summer to Remember

The School of EEE hosted a special tea reception for five students from NTU's Summer Research Internship (SRI) Programme and seven students from the EEE Research Attachment Programme (ERAP) on 13 June 2013. These two programmes were initiated to stimulate a culture of research for overseas undergraduates, as well as provide them the opportunity to develop their research interests with NTU. Faculty members mingled with the interns, discussed and interacted on several possible research avenues. The interns, who came from universities in United States, Canada, France, Poland, India, Thailand, Vietnam and Indonesia, shared their backgrounds, and expressed their excitement and happiness in participating in the SRI and ERAP Programmes.

We hope that the programmes would encourage the interns to apply for SINGA or other scholarships to study their Ph.D. at NTU in the future.

Sensory Overload on EEE Night

The magnum opus event that marks the end of EEE week.

Over the years EEE Night has become an iconic symbol of our school's cultural richness and creative abundance. The evening of 10 March 2013 saw a magnificent turnout of students, families, friends and professors for the EEE Night 2013, and another starry night was added to the EEE Club's history books.

The welcome speech by Mr Zeng Xinyi, President of the 31st Management Committee was followed by a short address by Prof Cheng Tee Hiang, then Acting Chair of the School of EEE, to kick-off the evening's programme. The variety of performances including five different groups of contestants from EEE's Got Talent competition was a wonderful showcase of the acting, singing and dancing skills of the multi-talented school. Mayank Moody, a 2nd year student won the event.

That evening we also crowned Ms and Mr EEE—Zhang Ao and Jiang Shan. Both freshmen have displayed the inherent multi-dimensional personalities of EEE students.

A Memorable Night to Reminisce

2013 PhD Graduation Dinner

"Remember tonight…for graduation is not the end, but the beginning of Wonderful times and Memories that will never fade away"

Laughter, song and music to celebrate a milestone event. The EEE Ph.D. Class of 2013 came together for their Graduation Dinner on 27 July 2013 at the Rendezvous Grand Hotel Singapore. Guest-of-Honour, Prof Yoon Soon Fatt, Chair of EEE, graced the event that was well-attended by graduates, the EEE School Management Faculty staff and supervisors.

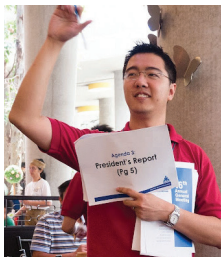
The sumptuous dinner was second only to the entertainment that evening: "Two Halfs" performance belted out classic golden rock oldies; Prof Er Meng Joo mesmerised the audience with his amazing adaptation of Li Mao Shan's famous song "綠島小夜曲- Lv Dao Xiao Ye Qu"; Vernon Lim of the Toastmaster student club tickled the audience with his talk; and four sporting couples kicked up their heels for the Lindy Hop dance challenge.

A video capturing photos of graduates with their short messages was aired that evening. It was a touching and moving expression of NTU experiences, graduation, and thank-you words for family, friends or staff. Supervisors also chipped in their photos and congratulatory messages for their students. One graduate, Dr Chew Boon Seng shared his feelings and thoughts of graduation as a new beginning of life with challenges ahead. At the end, the befitting Yum Seng, a toast to everyone present, rang out strong and confident.

01 02 03

01 "Two Halfs" Band Performance
02 Welcome Address by Chair of EEE, Prof Yoon Soon Fatt
03 "Yum Seng" to a bright future ahead!

01 02



01 First "silent" AGM led by EEEAA 15th Exco Secretary, Khur Boon Kgim, with elaborated signalling
02 The picture tells it all—a great group photos amidst the Supertrees and with the Marina Bay Sands as the backdrop

Alumni AGM Amidst Majestic Flora

Under the towering supertrees at the picturesque Gardens by the Bay, the NTU EEE Alumni Association (EEEAA) Executive Committee (Exco) took on the monumental task of organising the 16th Annual General Meeting (AGM) on 15 September 2013.

Under the towering supertrees at the picturesque Gardens by the Bay, the NTU EEE Alumni Association (EEEAA) Executive Committee (Exco) took on the monumental task of organising the 16th Annual General Meeting (AGM) on 15 September 2013. A total of 103 adults and children (not counting the many bubbly babies) turned up for the event which started at the Hill Street Coffee Shop @ SuperTree Dining, all in the spirit of fun, friendship, family and shared memories.

The talented Exco demonstrated their creativity and competency by crafting the AGM in the form of a "silent meeting". Booklets covering the agenda of the AGM were distributed to attendees, and helpers displayed flashcards to mediate the flow of information. The meeting went as smooth as silk. Even our special guest, Prof Kam Chan Hin, was impressed by the Exco's ingenuity.

The meeting ended briskly with the newly elected 16th Executive Committee to be led by the President, Hendri Zhang. All attendees then participated in a leisurely stroll to the conservatories. The highlights included the 11 Supertrees which were embedded with photovoltaic cells to harvest solar energy; the enthralling indoor waterfall as well as the 35-metre tall mountain in the Cloud Forest attraction; various plants, orchids, bromeliads and even carnivorous pitcher plants! From the peak they walked down in awe of the stunning display of Stalactites and Stalagmites. The Flower Dome enthralled the group with its colourful flowers from the Mediterranean regions, South Africa, California, Spain and Italy. With the backdrop of the Singapore Flyer and the Marina skyline, it was as if Singapore had transformed herself into a Mediterranean paradise!

As the sun set and the stars began to glimmer, the EEEAA AGM event ended on a successful note and was another feather in the committee's cap!

The TYVM Awards—Dressed for Success

01 02

01 To say "Thank You" are the red lips from beauties and the smiles from hunks
02 Prof Yoon and Prof Chang, together with the team behind the TYVM scene

About 500 participants rocked the luxurious ballroom of Marina Bay Sands Singapore at the EEE Graduates' Evening (GE2013) held on 17 August 2013. Entitled The TYVM ("Thank You Very Much") Awards, the red carpet event welcomed professors, students and guests, who came dressed in their finest.

The emcee, Henry Foo, kicked off the evening's festivities by inviting Guest-of-Honour, Prof Er Meng Hwa (Vice President of International Affairs) and Prof Yoon Soon Fatt (Chair of EEE) to address the 2013 cohort of graduates. There were nostalgic moments when a special video was shown of memories captured of the EEE students on their four years at NTU. Thereafter the evening's excitement grew to a feverish pitch as the participants savoured the delectable dishes and were entertained by performances from the Jazz and Blues Club, Salsa En Sync, and EEE Year 3 undergraduate Yu Sihan.

The evening also witnessed several individuals honoured with the Nanyang Teaching Award and EEE Excellence Award. The celebrities of the night were our newly-crowned Queen and King, Lin Huining and Benjamin Lim, and not forgetting the lucky draws. And with a

E3 Spirit Cup Kick-Off

The E3 Spirit Cup is the first of its kind, in Singapore and probably worldwide too.

A friendly Futsal tournament held on a cloudy morning on 11 May 2013 welcomed an amazing gathering of three facets of the NTU fraternity—the students, the staff and the alumni. The crowd of spectators, friends and family gathered at NTU SRC Multipurpose Field 2 for the kick-off was loud and ecstatic; they were there to support and cheer their favourite team.

This event was organised by a sub-committee of NTU EEEAA 16th Exco, led by Zhai Yao and comprised of members Muhammad Ali, Arshad Kashif, Hendri Zhang, Sim Teong Chuan and May Lim. The initial plan to have eight teams was doubled due to the overwhelming response, and in the end there were about 100 players in 16 teams. Unfortunately, one team had to be turned away. Prof Chang Chip Hong, EEE's Assistant Chair (Alumni) was the Guest-of-Honour for the occasion.

The field was divided into three wards of equal dimensions. The tournament rules and procedures had to be modified to suit the timeframe. Each match consisted of only one half instead of two halves. Female players were allowed on the teams and each goal scored by a female player would be counted as two goals. Each division had four teams and they had to fight their way through the qualification rounds and semi-finals to emerge the winner. A total of 28 matches were played.

Many exciting moments were seen during the tournament, from fantastic shootouts to amazing handling of the ball. Team Angkat Bola emerged as the tournament champion and all top three winners received their Gold, Silver and Bronze medals respectively. The committee looks forward to organising another successful and exciting tournament next year.

Futsal, an exciting, fast-paced small-sided football game, is officially recognised by both UEFA and FIFA. Futsal is a format of five-a-side football, normally played on a flat indoor pitch with hockey-sized goals and a size 4 ball with a reduced bounce.

final toast, a fitting tribute was given to the graduates for making it through the notoriously rigourous NTU EEE course. Whether or not they actually won any of the prizes, everyone walked away a winner that night, with a grand and satisfying closure to the undergraduate life of the EEE Class of 2013.

Be Guided by your Principles

"Stick to your beliefs in whatever things you do. Be confident and do not waver or be discouraged from the minor setbacks, as they are the cornerstones to the path of success."

Dr Kelvin Yong, EEE Alumnus and co-founder of BioMachines Pte Ltd, views decision-making as an important part of life as it seriously determines future results, paths and destinations. "I firmly believe in my own principles and guidelines and decide on things based on them. In this way, I will be firm, determined and consistent in my actions regardless of how uncertain and difficult the situation becomes."

Looking back, he remembers that he chose to study in the School of EEE because he found the operation of electrical components fascinating. Kelvin obtained his BEng in 2003, and went on to get his Ph.D. in 2010. Although he enjoyed the field of research, he realised that he could do more. After a few trips to Silicon Valley, USA, he discovered that he could actually create and innovate as an entrepreneur using his in-depth analytical skill and knowledge about technologies.

With encouragement and support from his wife, Gean, and his family, he switched his career path from research to entrepreneurship. Kelvin considers this as his most significant achievement so far.

"The challenge is really steep and a 360 degree change in the nature of the role. This will never be possible without strong support, determination and perseverance." He also acknowledges the immense encouragement from his Ph.D. supervisor, Prof Cheng Tee Hiang.

His firm BioMachines is funded under the NRF Technology Incubation Scheme (TIS) in Small World Group (SWG) incubator, providing a one-stop common online platform for sensors monitoring mainly in places without electricity grids. His passion extends to teaching as well as mentoring; he is the programme mentor for the prestigious NUS entrepreneurial programme, iLEAD—to mentor students during their internship in start-ups.

Kelvin wants to contribute more in the development of the entrepreneurial ecosystem in Singapore. For his alma mater, he believes that there should always be a pool of entrepreneurs with very strong ties to a successful university; these entrepreneurs could be professors, students or alumni. He looks forward to future collaboration work with fellow alumni.

Fighting Against the Odds

Not having the ability to hear may not have been easy on her but it has certainly not slowed her down.

EEE Alumnus, See Hai Shu, remembers her first achievement in life—crossing over to the Express stream at the end of her second year in secondary school. Next was receiving her Bachelor's degree in EEE.

It was a hard-won achievement as she encountered roadblocks such as getting a low GPA which caused her to lose heart. But when it comes to facing life's many setbacks, Hai Shu believes in persevering till the end. "Pick yourself up and give a good fight! It does not matter if you win or lose; in the process you toughen up and you become a better fighter," she advises.

It is quite an anomaly for hearing-impaired students to pursue a career in the engineering field. "Most deaf persons would choose a degree in the art, accounting or IT fields," says Hai Shu. Her decision stemmed from her love for Mathematics. During her time in Ngee Ann Polytechnic, she was exposed to the fundamentals of electrical engineering.

Although she secured a job at ST Marine's electrical department, her need to broaden her knowledge and contribute more significantly motivated her to enrol in the School of EEE. Yet, despite her prior successes, Hai Shu was not above doubt. "I used to wonder if I was good enough to compete with the bright students." It was with the support of her mother—her guiding light—that she finally made the decision to take up the degree.

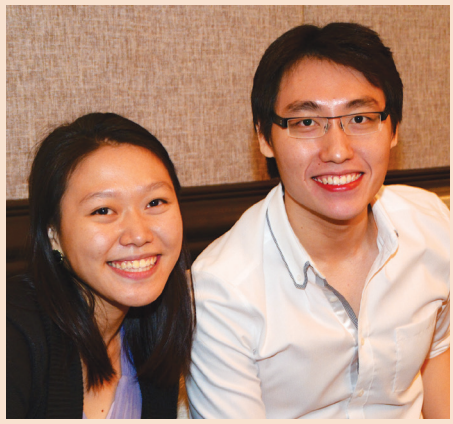
After graduation, she remains loyal to ST Marine for giving her the chance to work and she hopes to apply what she has learnt during her course of study. "I really want to change the perception that engineering is not suitable for deaf persons."

Being Prepared is Half the Battle Won

Every student's experience at the School of EEE is different. Henry Ng, a valedictorian for NTU Convocation 2013, shares with eee world how NTU prepared him for the future.

Even in his freshman year, word of the infamous killer module had already reached Henry's ears. EE3003, Integrated Electronics. Those who had survived it would cock their heads and reminisce at the mere mention of it while those who have not would continue to be mystified.

It was the task of analysing multi-operational amplifiers that was daunting to Henry. But like a bona fide EEE student, he took it in stride, soldiered on and tackled the subject. "Credit must be given to the lecturers who tried their best to make sure the content remained interesting and digestible," says Henry.



It was during the mugging for this module that Henry forged closer bonds with his classmates. "We formed our own study groups and helped one another to understand flummoxing concepts. We also learnt to pick ourselves up from the setbacks and encouraged one another to stay resilient."

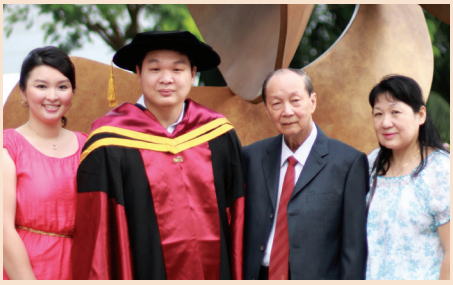
During the four-year degree programme, Henry was exposed to the many facets of electrical and electronic engineering. His specialisation was in Infocommunication, specifically digital media. "I learnt about web application development and I also got to perform signal processing for image rendering." As a member of the EEE-LEAD programme, a premier

leadership programme for selected EEE students that enriches their personal and professional capabilities, he was also involved in numerous activities from humanitarian work, project management to team-bonding, mentoring and training sessions for his EEE juniors.

Henry believes a degree in electrical and electronic engineering is not just a springboard to getting a good job. How one spends his time in the university is equally important. It was here at the School of EEE that he built strong friendships and developed lifelong skills while undertaking a plethora of projects. There were opportunities for him to develop his character, traits and values that would govern his decisions later on in life. "It was a safe training ground for us to experiment and 'calibrate' ourselves before we go out to the working world."

Making a Difference

The pursuit of a Ph.D. comes with a set of challenges. Valedictorian Chew Boon Seng shares encouraging words with all.



"What counts in life is not the mere fact that we have lived. It is what difference we have made to the lives of others that will determine the significance of the life we lead."

This was the Nelson Mandela quote Boon Seng shared with his fellow graduates at the EEE Ph.D. Graduation Dinner 2013. A fitting one, as it hints to the ensuing fruits of labour a Ph.D. holder gets to enjoy after all is said and done.

The stress that weighed heavily on his shoulders, the fear of disappointing those closest to him and the countless nights perfecting a single journal or transaction manuscript—these were just a few challenges that characterised Boon Seng's experience. Two things kept him going. First, the unwavering support he got from his loving wife, friends as well as supervisors such as Dr Chau Lap Pui and Dr Yap Kim Hui. Second was the will to make a difference.

"Being a Ph.D. is merely a start state. What is important is how we put to good use the knowledge and experiences we gained from the studies." Boon Seng philosophically implored one and all present to think about how they can, in their very own special ways, be constructive change agents capable of making a positive difference.

ISSCC 2013: First Milestone in the Bag

The International Solid-State Circuits Conference (ISSCC) is an annual event that brings together systems designers from all parts of the world.

01 02

01 Yi Xiang, winner of 2013 ISSCC Silkroad Award
02 IEEE International Solid-State Circuits Conference (ISSCC) Press Conference on 27 November 2012 at Goodwood Park Hotel, Singapore

This global forum highlights the latest advances in solid-state circuits and offers engineers a chance to network with industry luminaries.

The theme for this year's conference is "60 Years of (Em) Powering the Future", encapsulating the many ways circuit innovations have and will continue to change the world.

For the first time ever, Singapore was invited to host the ISSCC press conference. Amongst those in attendance were Guest-of-Honour Mr Teo Ser Luck, Minister of State for Trade and Industry as well as Prof Freddy Boey, Deputy President and Provost, NTU. This opportunity signifies Singapore's increasingly pivotal role in the global landscape of integrated circuit (IC) design.

This year, some 629 papers of innovative chip implementations and measurements were submitted for consideration. It was a great win for the local IC design community when a record-breaking number of five papers were accepted for presentation.

With this milestone, Singapore has also become the fourth highest contributor in Asia—following Japan, Korea and Taiwan—and the eighth overall in the world.

Even more heartening news: Four of the five accepted papers were from VIRTUS, NTU. The topics covered include biomedical, wireless, power harvesting and mm-wave.

For his research on the 60GHz Frequency Synthesizer, our postgraduate student, Yi Xiang, was selected as the Silkroad Award Winner. This makes him the first recipient from Singapore to receive this award.

These notable achievements attest to VIRTUS' strong research capabilities in IC design. The accolades would not have been possible if not for the tireless efforts of Asst Prof Boon Chirn Chye, Assoc Prof Siek Liter, Asst Prof Zheng Yuanjin, as well as our collaborators at A*STAR Institute of Microelectronics and National University of Singapore.

Congratulations to all the authors!